

## ORIGINAL ARTICLE

## Effect of Hospital Accreditation Process in Outcomes of Patients with Acute Coronary Syndrome

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### Abstract

**Background:** Hospital accreditation has as goal the standardization of patient care, aiming quality improvement. On 2015, a cardiology reference hospital was evaluated and got level 3 from ONA in care given to Acute Coronary Syndrome (ACS) patients.

**Objective:** To compare length of stay (LOS) at Coronary Care Unit (CCU) and the total LOS at the hospital of ACS patients before and after ONA 3 accreditation. Other clinical outcomes were also analyzed.

**Methods:** Systematic and prospective registry of admitted ACS patients at CCU, whose population was divided into pre-accreditation (period 1) and post-accreditation (period 2). Descriptive analysis was performed. For statistical analysis the Mann-Whitney test, chi-squared, Fisher's exact test and Multiple Linear Regression were performed. P value was considered statistically significant when  $< 0,05$ .

**Results:** 372 patients were admitted with ACS, 186 in period 1, of which 47 (25,3%) with ST segment Elevation Myocardial Infarction (STEMI), and 186 in period 2, of which 70 (37,6%) with STEMI. The mean age was 65,9 years ( $\pm 12,2$ ). About the CCU LOS, there was a reduction from 3 (IQR: 2-4) to 2,5 days (IQR: 2-4; p value = 0,088). Regarding the hospital LOS, there was also a reduction from 8 (IQR: 5-12,25) to 6 days (IQR:4-11; p value = 0,004). Analyzing the type of ACS, there was a significant reduction only at the hospital LOS in non-STEMI patients: 8 to 6 days (p value = 0,001). Other hospitalization length of stay and clinical outcomes did not present a significant reduction in the comparison.

**Conclusion:** After the ONA 3 accreditation, there was a reduction of hospital LOS. There were no significant differences in the other outcomes analyzed. (Int J Cardiovasc Sci. 2019;32(6):607-614)

**Keywords:** Hospital Accreditation; Consensus; Acute Coronary Syndrome; Data Interpretation, Statistical; Coronary Care Units.

### Introduction

Institutions that offer health services face challenges in improving safety and quality<sup>1-4</sup>, and it is therefore critical that a global organization be in place for all sectors to work in a systematic way<sup>1,5</sup>. Constant evaluation of this system proves to be useful to ensure its smooth operation<sup>3,6</sup>. Hospital quality certification has then emerged. It is a process of continuing professional education that helps

to encourage perfecting through multidisciplinary procedures that improve patient hospitalization and ensure lower rates of in-hospital complications.<sup>3,6-8</sup>

Hospital accreditation programs, which are forms of certification in many parts of the world have proven to be a method that assists in the evolution of the quality of health services, besides serving as an external validation of the service<sup>1-3,9,10</sup>. These programs analyze many criteria, ranging from hospital infrastructure to teaching and

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DOI: 10.5935/2359-4802.20190034

Manuscript received April 03, 2018; revised manuscript August 20, 2018; accepted October 09, 2018.

research and patient care service<sup>6</sup>. In Brazil, we have the National Accreditation Organization (ONA) that follows the standards established by the Ministry of Health<sup>1</sup>, where the institution is evaluated and receives a classification ranging from level 1 to 3, which represents accreditation with excellence.<sup>3,11</sup>

Several studies have analyzed the positive effects of the process and have found that there was a reduction in the length of hospital stay, improved management of preventable outcomes, reduction of hospital mortality, and it helps to create internal protocols.<sup>12-15</sup>

Coronary artery disease (CAD) is the most frequent cause of death in the world, consisting of approximately 13% of all causes of mortality.<sup>16,17</sup> Acute coronary syndrome (ACS) in Brazil represents an important cause of hospitalization and acute myocardial infarction is the second leading cause of death in the country.<sup>18,19</sup> These data demonstrate the importance of adequate management of ACS, especially with regards to the creation of guidelines.<sup>20</sup>

The length of stay in both the Intensive Care Unit and at the hospital is an important parameter of quality and better prognosis for the patient, where a decrease of this time is related to reduced hospital costs with the patient and a lower rate of complications, such as lower readmission rates, death or infection (such as mechanical ventilation-related pneumonia, central venous catheter infection or urinary tract infection related to bladder catheter use).<sup>21</sup>

In a reference Cardiology hospital in Salvador, Bahia, ACS was considered the main line of care in the ONA 3 accreditation process, held in December 2015.

The primary outcome of this study was the comparison between length of stay at the Coronary Care Unit and hospital stay of patients with ACS before and after ONA 3 accreditation. Secondly, the impact of accreditation on clinical outcomes was analyzed.

## Methods

### Study design and population

This is a prospective observational registry that consecutively included patients diagnosed with Acute Coronary Syndrome hospitalized at the Coronary Care Unit (CCU) of Hospital Santa Izabel (HSI) — Salvador/BA from February 2015 to August 2016. *Santa Casa de Misericórdia da Bahia* — HSI is a tertiary philanthropic hospital that underwent ONA 3 accreditation (excellence)

in December 2015 and successfully achieved this goal. The study population was divided into two groups: Period 1 (Pre-accreditation: before December 1, 2015) and Period 2 (Post-accreditation: as of December 1, 2015).

All patients with diagnostic confirmation of acute coronary syndrome (including unstable angina, ST-segment elevation acute myocardial infarction — STEMI — and non-ST-segment elevation acute myocardial infarction — non-STEMI) met the inclusion criteria, as well as patients receiving drug and/or interventional treatment for acute coronary syndrome at Hospital Santa Izabel. Patients readmitted after elective interventional treatment of previous acute coronary syndrome were excluded.

The data were collected prospectively through a structured electronic medical record of the coronary care unit by a team specifically involved in the collection, completed by the unit's attending physician, always with the possibility of rediscussing some topic with the physician. In summary, the variables include socio-demographic and clinical aspects, in addition to admission, evolution and outcomes.

### Statistical analysis

A descriptive analysis of the frequencies of variables was performed using IBM SPSS Statistics 14.0.

Initially, the Kolmogorov-Smirnov test of normality was performed to find out whether the variables had a normal or non-normal distribution pattern and, from this, the statistical tests and the most adequate description of each variable were defined.

The variables were described using measures of central tendency (mean, median) and dispersion (standard deviation, interquartile range) when continuous and by absolute and relative frequencies, for the categorical variables.

Comparisons of clinical outcomes between the pre- and post-accreditation periods were performed using the chi-square test ( $X^2$ ) or Fisher's exact test when the sample number was  $< 5$ . The Mann-Whitney test was used to compare the time of hospitalization at the coronary care unit and hospital admission between the two periods, since non-parametric variables were involved.

In addition, multivariate analysis was performed by multiple linear regression to find out where the hospital accreditation process was an independent predictor of length of hospital stay and length of stay at the CCU, controlling for relevant confounding factors in the

context of acute coronary syndrome (age, sex, type of ACS, systemic arterial hypertension, diabetes mellitus, dyslipidemia, previous infarction and prior coronary artery bypass grafting surgery).

The differences observed in all statistical tests (non-parametric and linear regression) were considered significant when the probability (p) of type I error was  $< 0.05$ .

## Results

A total of 372 patients were included in the study, of which 186 in period 1 (pre-accreditation) and 186 in period 2 (post-accreditation). Of the total, 117 (31.5%) were patients diagnosed with ACS with ST-segment elevation and 255 (68.5%) were diagnosed as non-ST-segment elevation ACS.

In period 1, 47 (25.3%) patients with ST-segment elevation and 139 (74.7%) with non-ST-segment elevation were admitted and, in period 2, 70 (37.6%) patients with ST-segment elevation and 116 (62.4%) patients with non-ST-segment elevation were admitted.

Male sex was the most prevalent one, with 211 (56.7%) patients; 110 (29.6%) were from the public health system

—SUS; and, as for the medical history, the most prevalent comorbidities were systemic arterial hypertension —SAH, totaling 299 (80.4%) patients, and dyslipidemia, with 187 (50.3%) patients. (Table 1)

The average age was 65.9 ( $\pm 12,2$ ), with minimum age of 14 and maximum of 95.

Regarding the length of hospital stay, in the total period of the study, the median CCU length of stay was 3 (IQR = 2 - 4) and the hospital length of stay was 7 days (IQR = 5 - 11.75). In period 1, the median was 3 days (IQR = 2 - 4) for the CCU length of stay and 8 days for the hospital length of stay (IQR = 5 - 12.25). In period 2, the median was 2.5 days for the CCU length of stay (IQR = 2 - 4) and 6 days for hospital length of stay (IQR = 4 - 11).

By analyzing the median variation between the CCU length of stay and the hospital length of stay between the pre- and post-accreditation periods, it was found that the reduced hospital length of stay in the general sample was statistically significant at  $p = 0.004$ . (Table 2)

In the analysis of subgroups, the median remained with a tendency of reduction, but only the decrease in hospital length of stay of non-STEMI was relevant, with  $p = 0.001$ . (Table 2)

**Table 1 - Prevalence and comparison of sociodemographic characteristics and presence of comorbidities between pre- and post-accreditation periods in a reference cardiology service. Salvador-Bahia, 2018**

Variable	General* (n = 372)	Pre-accreditation* (n = 186)	Post-accreditation* (n = 186)	p value
STEACS (%)	117 (31.5)	47 (25.3)	70 (37.6)	0.01
Male (%)	211 (56.7)	111 (59.7)	100 (53.8)	0.250
Health insurance (%)	262 (70.4)	134 (72)	128 (68.8)	0.495
SAH (%)	299 (80.4)	152 (81.7)	147 (79)	0.514
Diabetes mellitus (%)	159 (42.7)	78 (41.9)	81 (43.5)	0.753
Previous AMI (%)	110 (29.6)	46 (24.7)	64 (34.4)	0.041
Previous coronary artery bypass grafting surgery (%)	36 (9.7)	19 (10.2)	17 (9.1)	0.726
Dyslipidemia (%)	187 (50.3)	108 (58.1)	79 (42.5)	0.003
Previous stable angina (%)	78 (21)	39 (21)	39 (21)	1.000
Previous heart failure (%)	30 (8.1)	16 (8.6)	14 (7.5)	0.703
Previous angioplasty (%)	82 (22)	40 (21.5)	42 (22.6)	0.802

(\* Absolute frequencies; Absolute numbers and percentages on the total sample. Chi-square test; STEACS: ST-segment elevation acute coronary syndrome; SAH: systemic arterial hypertension; AMI: acute myocardial infarction.

**Table 2 - Comparison of the median length of stay at the CCU and hospital stay in the pre- and post-accreditation periods at a reference cardiology service. Salvador-Bahia, 2018**

Variable	Pre-accreditation	Post-accreditation	p value
CCU length of stay			
General (median, IQR)	3 (2-4)	2.5 (2-4)	0.088
STEACS (median, IQR)	3 (2-4)	2 (2-4)	0.052
Non-STEACS (median, IQR)	3 (2-4)	3 (2-4)	0.427
Hospital length of stay			
General (median, IQR)	8 (5-12.25)	6 (4-11)	0.004
STEACS (median, IQR)	8 (5-10)	7 (4.75-12.50)	0.734
Non-STEACS (median, IQR)	8 (5-14)	6 (4-10)	0.001

*Mann-Whitney test; IQR: interquartile range; CCU length of stay: length of stay in the Coronary Care Unit; STEACS: ST-segment elevation acute coronary syndrome; Non-STEACS: non-ST-segment elevation acute coronary syndrome.*

Regarding the secondary outcomes, it was found that the type of clinical outcome most commonly presented in the sample was cardiorespiratory arrest (CRA) of any type, evolving to death or not (29 patients — 7.8%), followed by death (26 patients — 7%). Comparing the two periods, period 1 had a higher number of deaths than period 2 (14 and 12, respectively), but this data did not reach statistical relevance. (Table 3)

By cross-comparing the data, it was found that mortality and cardiogenic shock were variables that showed a decrease in the number of cases between the pre- and post-accreditation period, but this data did not reach any statistical significance. Reinfarction, CRA (resulting in death or not) and combined outcomes showed an increase in the absolute number of cases in the comparison between the two periods analyzed, but this difference did not present a significant p-value. (Table 3)

By analyzing the clinical outcomes correlated to the types of ACS, it was found that some outcomes increased and others decreased in frequency in the comparison between the pre- and post-accreditation periods, but this change is not statistically relevant. (Table 3)

In the multivariate analysis by multiple linear regression, controlling for the variables of age, sex, systemic arterial hypertension, diabetes mellitus, dyslipidemia, previous acute myocardial infarction, previous coronary artery bypass grafting and type of ACS, the post-accreditation period was an independent predictor of reduced time of hospitalization ( $p = 0.041$ ;  $B = 2.081$ ;  $\beta = 0.105$ ).

By doing the same analysis for the hospitalization time at the coronary care unit, we found that accreditation was not an independent predictor of this change in length of stay ( $p = 0.834$ ;  $B = 0.086$ ;  $\beta = 0.011$ ).

## Discussion

The accreditation process has a positive impact on the standardization of care offered to patients, generating a flow that results in faster and more effective practices, contributing to a better patient prognosis.<sup>22</sup>

At Hospital Santa Izabel, where this study was conducted, the hospital accreditation process resulted in better health care processes and had a strong impact on the pursuit of patient safety. With regard to acute coronary syndromes (ACS), its line of care was devised by conducting analyses before the patient arrived at the hospital until their follow-up after discharge. Mortality and bleeding outcomes were established as indicators of the line of care, and these outcomes were adjusted by the GRACE score and the CRUSADE score obtained on admission to the coronary care unit. A set of measures were planned and implemented at the different phases of the line of care, such as taking joint actions with the Municipal Health Department and SAMU (Mobile Emergency Care Service), aiming at improving the time to the implementation of reperfusion in ST-segment elevation acute myocardial infarction. Another relevant aspect was the construction of a therapeutic plan for

**Table 3 - Comparison of the frequencies of outcomes between the pre- and post-accreditation periods in a reference cardiology service. Salvador-Bahia, 2018**

Variable	Pre-accreditation* (n = 186)	Post-accreditation* (n = 186)	p value
Death			
General (%)	14 (7.5)	12 (6.4%)	0.684 <sup>a</sup>
STEACS (%)	3 (1.6)	7 (3.8%)	0.738 <sup>b</sup>
Non-STEACS (%)	11 (5.9)	5 (2.7%)	0.237 <sup>a</sup>
Reinfarction			
General (%)	5 (2.7)	11 (5.9%)	0.125 <sup>a</sup>
STEACS (%)	1 (0.5)	5 (2.7%)	0.399 <sup>b</sup>
Non-STEACS (%)	4 (2.1)	6 (3.2%)	0.519 <sup>b</sup>
Cardiogenic shock			
General (%)	8 (4.3)	6 (3.2%)	0.586 <sup>a</sup>
STEACS (%)	2 (1.1)	4 (2.1%)	1 <sup>b</sup>
Non-STEACS (%)	6 (3.2)	2 (1.1%)	0.298 <sup>b</sup>
CRA (death or not)			
General (%)	14 (7.5)	15 (8.1%)	0.847 <sup>a</sup>
STEACS (%)	3 (1.6)	9 (4.8%)	0.357 <sup>b</sup>
Non-STEACS (%)	11 (5.9)	6 (3.2%)	0.382 <sup>a</sup>
Combined unfavorable outcomes	20 (10.7)	24 (12.9%)	0.521 <sup>a</sup>

(\*). Absolute frequencies. P values regarding the tests: a Chi-square test, b Fisher's exact test; STEACS: ST-segment elevation acute coronary syndrome; Non-STEACS: non-ST-segment elevation acute coronary syndrome; CRA: cardiorespiratory arrest.

each patient. The plan guides the therapeutic project of each area (nursing, physiotherapy, clinical practice, psychology, etc.), whose goals are always based on the pursuit of improvements of clinical results based on humanized practice. From the ONA 3 accreditation process, all prescriptions for the patients of the ACS line of care were then analyzed by the clinical pharmacist, who interacts directly with the medical team, by signaling nonconformities, risks and suggestions.

In this study, regarding the demographic characteristics of the sample, a higher mean age was found, with a difference of about 10 years, compared with the studies of Eagle et al.<sup>15</sup> and Chen et al.<sup>23</sup> which analyzed the impact of the evaluation of hospital services based on the standardization of these services. Moreover, this study has found a lower incidence of ACS in women and a higher prevalence of SAH compared to the results of the

two studies mentioned above.<sup>15,22</sup> There was also a higher prevalence of diabetes mellitus and previous angioplasty; approximately the same prevalence of previous acute myocardial infarction; and a lower prevalence of patients with heart failure compared to patients from the study of Chen et al.<sup>22</sup> It can be assumed that, because the population sample of Salvador has more comorbidities than the population analyzed by Eagle et al.<sup>15</sup> and Chen et al. al.<sup>22</sup>, the patients in the sample may be associated with earlier infarction, since a considerable difference was observed between the mean ages of the patients in this study and those of the other authors cited.

The hospitalization times at the Coronary Care Unit and at the hospital were analyzed and a tendency of reduced medians has been found. As for the total sample and that of patients with non-ST-segment elevation ACS, there was a significant reduction in the length of

hospital stay. Patients with ST-segment elevation also had a reduced length of hospital stay, but this data did not present any statistical significance.

In a multicenter study conducted by Sack et al.<sup>24</sup> in 73 hospitals, the quality of care offered and the patient's satisfaction with their hospitalization in accredited and non-accredited hospitals were analyzed.<sup>24</sup> The population considered was more comprehensive, excluding only obstetric patients and pediatric patients. As a result, it was found that the median length of hospital stay in accredited hospitals tended to be lower, but with no statistical relevance.<sup>24</sup> In the sample of this study, the population was more specific, and the reduction in hospital length of stay may be associated with a better systematization of care for these patients, which was confirmed in this study through a multivariate linear regression. Furthermore, it can be assumed that, with improved care, with protocols established and fulfilled, the patient presents more favorable conditions for early discharge. Also, regarding the length of stay, a study conducted by Falstie-Jensen et al.<sup>9</sup> also found that patients hospitalized in accredited hospitals had a shorter hospital stay,<sup>9</sup> which is consistent with this study.

Regarding the outcomes analyzed, in the current study, it can be seen that the tendency related to cardiogenic shock was a reduction in the sample studied and an increase in patients with STEMI. Regarding mortality, there was a decrease in this variable both in the sample as a whole and in patients with non-ST-segment elevation, but without statistical significance. In the analysis of subgroups, there was an increase in the number of deaths in patients with ST-segment elevation. Compared to the Eagle<sup>15</sup> study, it can be seen that the patients analyzed in the United States showed an increase in the number of cases of cardiogenic shock and that mortality decreased significantly.<sup>15</sup>

One possibility to be raised to increase the number of deaths of patients with STEMI is that there were more admissions of more severe patients in the second period analyzed. According to Greenfield et al.<sup>14</sup> by undergoing a quality assessment such as the hospital accreditation process, the institution tends to receive more patients with more serious disorders<sup>14</sup>, possibly due to the recognition of the effectiveness of the service offered.

Another issue to be emphasized is that the results on mortality obtained in this analysis should be interpreted carefully. In a study conducted by Williams et al.<sup>25</sup> in 2005, a dissociation was found between the variable in-hospital mortality of patients with acute myocardial infarction and

the other variables analyzed. These other variables were more associated with the quality of the service offered to the patient, and an improvement was perceived after the hospital evaluation process. The authors pointed out that previous studies reported a lower sensitivity of the clinical outcomes to the detriment of quality parameters with regard to the protocols established at the hospital.<sup>25</sup> In-hospital mortality refers to the management of a specific patient and does not necessarily shows the ineffective outcome of all other procedures of care provided during hospitalization.<sup>25</sup> Due to this, the number of deaths is not considered a good parameter in assessing the impact of the accreditation process.

Regarding the other variables of clinical outcomes, there was an increase in reinfarction and CRA, especially in patients with ST-segment elevation, but without significance. In 2015, Falstie-Jensen et al.<sup>9</sup> studied the relationship between accredited hospitals and acute readmission (up to 30 days), considering all patients admitted to the hospital, and it was found that patients seen in institutions certified as accredited institutions did not present any difference comparing with non-accredited hospitals.<sup>9</sup> Given that reinfarction can be considered a factor that would lead to acute readmission, this cause may be included in the context of the study.

### Limitations

This study has some limitations. Firstly, it includes data from a single hospital, with a relatively small sample. In addition, it is not possible to evaluate the secondary outcomes satisfactorily, since the sample size is not so big. Moreover, it was impossible to have a control group in parallel to the study, since it was conducted in two distinct periods, and the motivation of the team may imply different results. However, note that the motivation of the team is one of the benefits of the accreditation process. Another limitation was that the data of this study were secondary and were derived from medical records, although the researchers made sure they conducted an active search for any information that might be missing or doubtful.

### Conclusions

In conclusion, after the ONA 3 accreditation process, there was a reduction in hospital stay. There were no significant differences in the frequency of hospital mortality or combined clinical outcomes, as well as in the length of hospital stay at the CCU.

## Author contributions

Conception and design of the research: Leite CD, Pereira TC, Freitas MP, Tinôco NLW, Pereira FG, Menezes RVLV, Feitosa-Filho GS. Acquisition of data: Leite CD, Pereira TC, Freitas MP, Tinôco NLW, Pereira FG, Menezes RVLV, Andrade MQS, Vilas Boas SPRV. Analysis and interpretation of the data: Leite CD, Tinôco NLW, Pereira FG, Menezes RVLV, Andrade MQS, Vilas Boas SPRV, Feitosa-Filho GS. Statistical analysis: Leite CD, Tinôco NLW, Pereira FG, Menezes RVLV, Andrade MQS, Vilas Boas SPRV, Feitosa-Filho GS. Writing of the manuscript: Leite CD, Barbosa PJB, Feitosa-Filho GS. Critical revision of the manuscript for intellectual content: Leite CD, Pereira TC, Freitas MP, Tinôco NLW, Pereira FG, Menezes RVLV, Andrade MQS, Vilas Boas SPRV, Barbosa PJB, Feitosa-Filho GS.

## Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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## Sources of Funding

There were no external funding sources for this study.

## Study Association

This study is not associated with any thesis or dissertation work.

## Ethics approval and consent to participate

This study was approved by the Ethics Committee of the Hospital Santa Izabel under the protocol number 41496815.7.0000.5520. All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

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